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February 16, 2007

Mr. John Morris
Director
Newburyport Board of Health
City Hall, 60 Pleasant Street
Newburyport, MA 01950

Subject: Crow Lane Landfill, Newburyport, MA
Independent Review of Perimeter Berm

Dear Mr. Morris:

Metcalf & Eddy has conducted an independent review of the proposed perimeter berm design at the Crow Lane Landfill as set forth in our February 13, 2007 Agreement. The intent of this review is to provide an independent opinion of whether or not the stability of the perimeter berm as designed is consistent with established geotechnical practices. Specifically, the following documents provided to us by your office were reviewed:

1. SITEC Environmental Supplemental Information Submittal to DEP, January 5, 2007, regarding the Corrective Action Design (Closure Plan) for the Crow Lane Landfill.
2. Corrective Action Design (CAD) Final Landfill Closure for Crow Lane Landfill, Newburyport, MA as prepared by SITEC Environment, Drawings 3, 5, 6, 11, 12, 13, 14, and 15, dated January 19, 2007
3. SITEC Environmental, January 19, 2007 transmittal letter to DEP, transmitting revised and supplemental drawings referenced in Item 2.

BACKGROUND

The berm for the perimeter road was originally designed by GZA, Inc. for SITEC Environmental as part of the closure of the Crown Lane Landfill in Newburyport, Massachusetts. GZA recommended constructing the berm with a relatively steep outer slope (1H:1V) using processed crushed concrete (3-inch maximum size) or crushed rock (6-inch maximum size) placed in controlled lifts to a maximum height of 43 feet. The specified foundation preparation consisted of removal of existing soft, organic soils from beneath the proposed berm footprint.

Reportedly, the landfill contractor, New Ventures Associates, LLC, was constructing the berm using a different material than specified by GZA. This prompted SITEC to retain GEOCOMP Corporation to investigate the composition of the existing berm and reevaluate the stability. GEOCOMP inspected 18 test pits that were excavated through the top of the berm and documented that the berm generally consisted of "processed construction and debris materials". A total of 11 gradation tests were performed on test pit samples to characterize the soil-size fraction of the berm material. One large size direct shear test was performed on a laboratory compacted specimen that was prepared using composite samples. Based on their stability analysis of the partially constructed berm, GEOCOMP concluded that completing the berm with a 1H:1V outer slope would not meet the minimum acceptable factor of safety of 1.3. Based on GEOCOMP's recommendations, SITEC revised the berm design using a combination of the following options:

- Construct the lower part of the berm with a flatter (1.5H:1V) outer slope using structural fill.
- Complete the top of the berm using Mechanically Stabilized Earth (MSE) with a nearly vertical outer slope.
- Construct stone buttresses or 1H:1V rip-rap slopes at locations where flattening the slope is not feasible without encroaching on the abutting wetlands

REVIEW OPINIONS

After review of the listed project documents, M&E offers the following opinions:

1. SITEC should provide documentation in the form of construction photographs or reports by an independent geotechnical inspector supporting the removal of soft, organic soils from within the footprint of the berm. If this layer was left in place beneath the berm, a deep-seated slide could occur even with the revised berm design. If SITEC cannot provide adequate documentation, additional subsurface investigation may be required to verify whether or not the soft, organic soils were removed. If soft, organic soils are encountered, the stability of the berm should be re-evaluated.
2. SITEC should provide supporting documentation that the existing berm was constructed as a controlled fill. Such a berm would typically be constructed in 9 inch lifts compacted with four or more passes of a vibratory compactor weighing more than 8 tons. If the berm was not constructed as a controlled fill, the friction angle of 38 degrees used by GEOCOMP in the stability analysis to model the shear strength of the fill may not be valid. If SITEC cannot provide adequate documentation, additional subsurface information may be required to establish the appropriate shear strength of the existing berm materials. If lower shear strength is established, the stability of the berm should be re-evaluated.
3. SITEC should provide the berm foundation information originally used in the GZA stability analysis. The GEOCOMP stability analysis assumed the same foundation conditions as previously used by GZA and may not have made an independent assessment of their validity. This information should include any subsurface investigation conducted along the landfill perimeter such as boring or test pits (including location and logs), soil laboratory testing and groundwater measurements.
4. SITEC should verify that the factor of safety against shallow, surficial slides (surface sloughing) on the outer face of the lower 1.5H:1V slope beneath the MSE berm is acceptable. Such slides may encroach on the abutting wetlands and could progressively undermine the overlying MSE berm. The GEOCOMP stability analysis does not appear to have addressed shallow, surficial slides. The section analyzed by GEOCOMP, where the berm height is the greatest, may not correspond to the critical location for this failure mode. The berm section where the 1.5H:1V slope height is greatest should be analyzed. Two possible critical locations for shallow slides are Section B-B' shown in Drawings 14 of the 1/19/07 amended plans or a section along the north side just before the transition from the 1.5H:1V slope to the 1H:1V rip-rap slope (see Drawing 13 of the 1/19/07 amended plans).
5. SITEC should provide specifications and Quality Control/Quality Assurance procedures for constructing both the 1.5H:1V slope and MSE berms in addition to the submitted plans.
6. SITEC should provide surface erosion protection for both the 1.5H:1V slope and MSE berm. Both Westerly and Southerly Perimeter Berm Details in Drawings 5 and 6, respectively, indicate that "MSE Berm Facing Material" is required. However, a detail or specification for this material has not been provided. The structural fill for the lower sloped berm, even if compacted to 95% of the maximum dry density per ASTM D 1557, will be susceptible to surface erosion. Because of the relatively steep slope, a vegetative slope cover may not be practical. Instead, SITEC should consider constructing the slope with a two-foot wide outer layer of 3 to 6 inch crushed stone as per GZA's original design. This modification would also increase the factor of safety against shallow, surficial slides as discussed in Comment # 3.
7. SITEC should provide a typical detail for the 1H:1V rip-rap slope showing the required gradation and layer thickness for both the rip-rap and bedding layer. As an example of a typical rip-rap detail, see the FLARED END W/RIP-RAP DETAIL on Drawing 6 of the 1/19/07 amended plans.

8. SITEC should provide details and specifications for constructing the proposed stone buttress at the base of the westerly and northerly slopes as shown in Drawing 13. Section A-A', Drawing 14 of the amended plans shows a 10 foot high stone buttress. This is a retaining wall of significant height and should be designed accordingly. Section A-A' does not provide sufficient detail for construction.

If you have any questions, please do not hesitate to contact me at 781-224-6122 or Doug Gove at 781-224-6316.

Very truly yours,
METCALF & EDDY

Jose Ramos

Jose Ramos, P.E.

Cc: Don Chelton, M&E
Doug Gove, M&E